

IN THE CLAIMS:

Please cancel claims 8 and 63 without prejudice or disclaimer.

Please substitute the following amended claims for the corresponding original claims. A marked copy of the claim amendments is attached hereto.

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1. (amended eight times) A process chamber for processing a substrate in a process gas and reducing emissions of hazardous gas to the environment, the process chamber comprising:
- (a) a support capable of supporting the substrate;
 - (b) a gas distributor capable of introducing process gas into the process chamber;
 - (c) a gas activator capable of activating the process gas to perform a process in the process chamber thereby forming effluent containing hazardous gas;
 - (d) an exhaust tube through which the effluent may be flowed, the exhaust tube being adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially absent projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, and (ii) that cause turbulence in the flow of the effluent through the exhaust tube; and
 - (e) an RF energy applicator to couple RF energy to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent.

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9. (once amended) The process chamber of claim 1 wherein the exhaust tube comprises an inlet and an outlet that are substantially facing each other in an opposing relationship.

10. (twice amended) A gas treatment apparatus for reducing a hazardous gas content of an effluent from a process chamber, the gas treatment apparatus comprising:

(a) an exhaust tube through which effluent from the process chamber may be flowed;

(b) an RF energy applicator to couple RF energy to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent;

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(c) a gas analyzer capable of monitoring the hazardous gas content of the effluent and providing a signal in relation to the hazardous gas content of the effluent; and

(d) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, performing at least one of the following:

(i) adjusting a power applied to the RF energy applicator to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

11. (twice amended) A process chamber for processing a substrate and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate in the process chamber;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas; and

(d) an exhaust tube through which the effluent may be flowed;

(e) an RF energy applicator to couple RF energy to the effluent to energize the effluent;

(f) a gas analyzer capable of monitoring the hazardous gas content of the effluent in the exhaust tube and providing a signal in relation to the hazardous gas content of the effluent; and

(g) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, performing at least one of the following:

(i) adjusting a power applied to the microwave energy applicator to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

J4 14. (once amended) The process chamber of claim 11 wherein the RF energy applicator is a microwave energy applicator to couple microwave energy to the effluent.

J5 24. (amended three times) A process chamber for processing a substrate in a process gas and reducing emissions of hazardous gas to the environment, the process chamber comprising:

- (a) a support capable of supporting the substrate;
- (b) a gas distributor capable of introducing process gas into the process chamber;
- (c) a gas activator capable of activating the process gas to process the substrate thereby forming an effluent containing hazardous gas;
- (d) an exhaust tube through which the effluent may be flowed, the exhaust tube being substantially absent projections or recesses; and
- (e) a microwave energy applicator adapted to couple microwaves to the effluent to reduce the hazardous gas content of the effluent.

26. (twice amended) A process chamber for processing a substrate in a process gas and reducing emissions of a hazardous gas to the environment, the process chamber comprising:

J6 (a) a support capable of supporting the substrate, a gas distributor capable of introducing process gas into the process chamber, and a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas;

(b) an exhaust tube capable of exhausting the effluent from the process chamber and a gas energizer adapted to energize the effluent in the exhaust tube to reduce a hazardous gas content of the effluent;

(c) a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and to provide a signal in relation to the hazardous gas content of the effluent; and

(d) a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content of the effluent is determined to exceed the safety level, performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

27. (twice amended) The process chamber of claim 26 wherein the program code comprises one or more of:

(1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,

(2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

(3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving an output signal indicating that the hazardous gas content of the energized effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

28. (twice amended) A computer program product for operating a gas treatment apparatus and process chamber, to reduce the hazardous gas content of an effluent formed during processing of a substrate in the process chamber, the gas treatment apparatus comprising an exhaust tube capable of exhausting effluent from the process chamber, a gas energizer adapted to energize the effluent in the exhaust tube to reduce the hazardous gas content of the effluent, and a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and provide a signal in relation to the hazardous gas content of the effluent, the computer program product comprising computer readable program code, the computer readable program code comprising:

(a) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes; and

(b) safety operational program code that, upon receiving a signal indicating that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

31. (once amended) The process chamber of claim 1 wherein the RF energy applicator comprises a waveguide to couple RF energy to the effluent in the exhaust tube.

33. (once amended) The process chamber of claim 14 wherein the microwave energy applicator comprises a waveguide to couple microwaves to the effluent in the exhaust tube.

34. (once amended) The process chamber of claim 11 wherein the RF energy applicator comprises facing electrodes or an inductor coil.

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cont 35. (once amended) The process chamber of claim 24 wherein the RF energy applicator comprises a waveguide to couple RF energy to the effluent in the exhaust tube.

37. (once amended) The process chamber of claim 1 further comprising:

59 (a) a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and to provide a signal in relation to the hazardous gas content of the effluent; and

(b) a computer controller system comprising computer readable program code capable of monitoring the signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

510 39. (once amended) The process chamber of claim 1 wherein the exhaust tube comprises monocrystalline sapphire.

511 48. (once amended) The apparatus of claim 10 wherein the RF energy applicator is a microwave energy applicator to couple microwave energy to the effluent.

49. (once amended) The apparatus of claim 10 wherein the program code comprises one or more of:

(1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,

(2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

(3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving a signal indicating that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

54. (once amended) The process chamber of claim 11 wherein the computer readable program code comprises one or more of:

- (1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,
- (2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

J12 (3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving a signal indicating that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

J13 62. (once amended) The process chamber of claim 24 wherein the exhaust tube comprises monocrystalline sapphire.

64. (once amended) The process chamber of claim 24 further comprising:

(a) a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and to provide a signal in relation to the hazardous gas content of the effluent; and

(b) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

514 (ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

65. (once amended) The process chamber of claim 64 wherein the [computer readable] program code comprises one or more of:

- (1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,
 - (2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,
 - (3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and
 - (4) safety operational program code that, upon receiving a signal indicating that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.
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J15 72. (once amended) The process chamber of claim 26 wherein the exhaust tube comprises monocrystalline sapphire.

73. (once amended) The process chamber of claim 26 wherein the gas energizer comprises an RF energy applicator to couple RF energy to the effluent.

Please add the following claims.

79. (New) A process chamber for processing a substrate in a process gas and reducing emissions of hazardous gas to the environment, the process chamber comprising:

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- (a) a support capable of supporting the substrate;
 - (b) a gas distributor capable of introducing process gas into the process chamber;
 - (c) a gas activator capable of activating the process gas to perform a process in the process chamber thereby forming effluent containing hazardous gas;
 - (d) an exhaust tube through which the effluent may be flowed, substantially the entire internal flow surface of the exhaust tube being parallel to a single direction of the flow of the effluent through the exhaust tube; and
 - (e) a microwave energy applicator to couple microwaves to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent.

80. (New) A process chamber for processing a substrate in a process gas and reducing emissions of hazardous gas to the environment, the process chamber comprising:

- (a) a support capable of supporting the substrate;
- (b) a gas distributor capable of introducing process gas into the process chamber;
- (c) a gas activator capable of activating the process gas to perform a process in the process chamber thereby forming effluent containing hazardous gas;
- (d) an exhaust tube through which the effluent may be flowed, the exhaust tube comprising an inlet and an outlet that are substantially facing each other in an opposing relationship; and
- (e) a microwave energy applicator to couple microwaves to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent.

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81. (New) A process chamber for processing a substrate and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate in the process chamber;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas; and

(d) an exhaust tube through which the effluent may be flowed;

(e) an RF energy applicator to couple RF energy to the effluent to energize the effluent;

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(f) a gas analyzer capable of monitoring the hazardous gas content of the effluent in the exhaust tube and providing a signal in relation to the hazardous gas content of the effluent; and

(g) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, adjusting a power applied to the microwave energy applicator to reduce the hazardous gas content in the effluent.

82. (New) A process chamber for processing a substrate and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate in the process chamber;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas; and

(d) an exhaust tube through which the effluent may be flowed;

(e) an RF energy applicator to couple RF energy to the effluent to energize the effluent;

(f) a gas analyzer capable of monitoring the hazardous gas content of the effluent in the exhaust tube and providing a signal in relation to the hazardous gas content of the effluent; and

(g) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent,

83. (New) A process chamber for processing a substrate and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate in the process chamber;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas; and

(d) an exhaust tube through which the effluent may be flowed;

(e) an RF energy applicator to couple RF energy to the effluent to energize the effluent;

(f) a gas analyzer capable of monitoring the hazardous gas content of the effluent in the exhaust tube and providing a signal in relation to the hazardous gas content of the effluent; and

(g) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, activating an alarm or metering display.

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84. (New) A process chamber for processing a substrate and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate in the process chamber;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas; and

(d) an exhaust tube through which the effluent may be flowed;

(e) an RF energy applicator to couple RF energy to the effluent to energize the effluent;

(f) a gas analyzer capable of monitoring the hazardous gas content of the effluent in the exhaust tube and providing a signal in relation to the hazardous gas content of the effluent; and

(g) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent.

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85. (New) A process chamber for processing a substrate and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate in the process chamber;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas; and

(d) an exhaust tube through which the effluent may be flowed;

(e) an RF energy applicator to couple RF energy to the effluent to energize the effluent;

(f) a gas analyzer capable of monitoring the hazardous gas content of the effluent in the exhaust tube and providing a signal in relation to the hazardous gas content of the effluent; and

(g) a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, terminating the process being conducted in the process chamber.